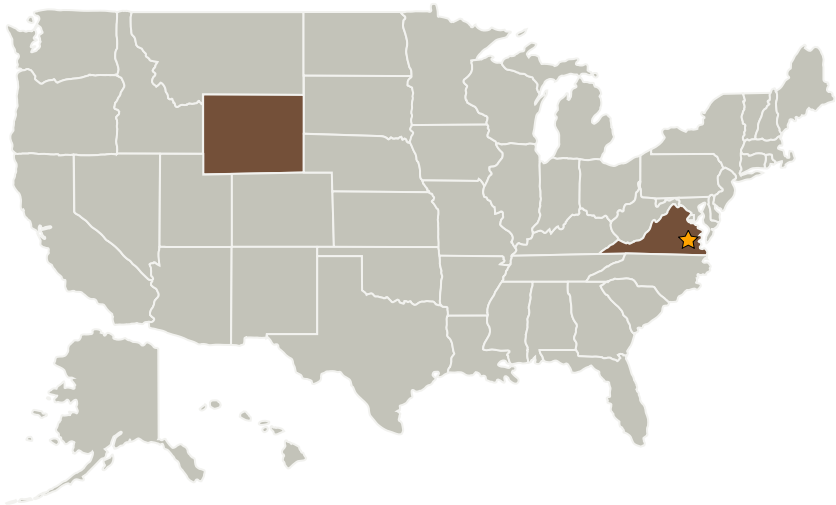
Sensitivity Analysis and Error Control for Computational Aeroelasticity, Phase I

Completed Technology Project (2007 - 2007)

Project Introduction

The objective of this proposal is the development of a next-generation computational aeroelasticity code, suitable for real-world complex geometries, and incorporating error-control for superior reliability and efficiency, and sensitivity analysis for aeroelastic design problems. The principal enabling innovation for achieving these goals involves the development of adjoint methods for time-dependent coupled aeroelastic simulations. The use of adjoint techniques has become widespread for steady-state aerodynamic design, and the potential of adjoint methods for controlling spatial error has been well documented. However, the extension of these methods to unsteady problems and coupled aero-structural problems has generally been lacking. Using a consistent and modular adjoint formulation, the proposed project will result in the incorporation of an adjoint methodology into an existing three-dimensional unstructured mesh aeroelastic simulation capability. The adjoint methodology will enable revolutionary advances in efficiency and reliability for computational aeroelasticity, by providing the means of controlling temporal error through time-step control for relevant engineering outputs, such as the determination of flutter boundaries. Sensitivity analysis will also be enabled, providing the means for performing aerodynamic shape optimization, structural modifications, as well as valuable information for guiding the placement, location and properties of flow control devices, actuators, and smart material technologies.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Scientific Simulations LLC	Supporting Organization	Industry	Laramie, Wyoming

Primary U.S. Work Locations	
Virginia	Wyoming

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.3 Aeroelasticity